

Phase I Project Summary

Firm: Dimension Technologies Inc.

Contract Number: NNX13CL15P

Project Title: High Resolution Autostereoscopic Cockpit display

Identification and Significance of Innovation:

During this Phase I program, DTI with its advisors - the Boeing Flight Deck Concept Center and DAD Technology, investigated the adaptation of its high resolution glasses free 3D display technology to cockpit applications. NASA and US Air Force studies indicate 3D will improve pilot situation awareness and interpretation of the cluttered information that is typically found on cockpit displays. The scope of the project included proving the feasibility of developing the electronic, software, content and mechanical interfaces to a Boeing aircraft system. A high resolution glasses free 3D display potentially has wide application for improved pilot situation awareness aboard a wide variety of aircraft, as well as air or space based telerobotic applications such as aircraft refueling and manipulator arm operation on the International Space Station. DTI's enabling technology represents a quantum leap forward in glasses free 3D display. 3D displays can be produced such that they possess the same amount of depth as glasses based displays and the same level of image quality in terms of resolution, brightness, screen size, color, and lack of visual artifacts and wide angle of view as a conventional 2D monitor at a cost commensurate with that of a 2D monitor.

Technical Objectives and Work Plan:

The major technical objectives:

- 1. Multiview to two-view**
 - Industry standardized on 60 Hz.
 - Enables full res 3D & greater depth.
- 2. OEM LCDs**
 - Size, resolution, and optical qualities.
 - Boeing agreed to provide displays.
- 3. Illumination system**
 - Investigated LEDs capable of operating at high temperatures without losing significant brightness.
 - Sunlight readable.
 - LEDs meet requirements.
 - Tested scheme to recover full resolution.
- 4. Adaptation of DTI 3D Technology**
 - Fit DTI's technology into the volume envelop allowed.
- 5. Power requirements**
 - As efficient as a conventional OEM system.
- 6. PC requirements**
 - Compatibility with the PCs used by Boeing and Rockwell.

7. Software requirements

- Able to move 3D to follow head movements.
- Application for developing a test media player
- Creates content in the DTI 3D format.

8. Phase II reference design

- Boeing agreed to test prototypes in their 787 engineer cab simulator.
- Demonstrated bench model

Work Plan:

1. Optical Development
 - Multiview to two-view
 - OEM LCDs
 - Diffuser requirements
 - Lenticular Lens
 - LEDs requirements
 - Compact optical design
 - Cockpit display requirements
2. Hardware Development
 - DVI interface
 - LED BLU IF
 - LED driver I/F
 - PC Requirements
3. Software Development
 - Software requirements
 - Head tracking and head tracking software
 - Content
4. Mechanical Development
 - Design concept
5. Project Management
 - Phase II reference Design

Technical Accomplishments:

Limitations in LCD speed in cockpit display sizes determined that DTI's two view high resolution display technology with face tracking should be used for this application. Better results will be achieved – 2D/3D switching, full resolution in 3D, no artifacts, wide head movement range.

A cockpit – in the form of a Boeing 787 cockpit simulator - was identified for development in Phase II and testing in Phase II/Phase III. Boeing will partner with DTI, provide DTI with a cockpit display for modification, and test the display in the simulator during Phase II/III – ideally leading to aircraft tests in Phase III.

Analysis indicates –

1. DTI illumination system will fit in the cockpit display.

2. Key cockpit LCD properties were defined.
3. High temperature laminates for the lenticular lens and diffuser were identified.
4. High temperature LEDs were found.
5. Computer system and OS used in the cockpit simulator was identified.
6. Software used in the cockpit simulator was identified
7. Adapt the software 3D display capabilities to DTI displays was identified.
8. Bench model testing of full resolution and head tracking concept was conducted.
9. A light guide design to reducing the number of LEDs was investigated.

NASA Application(s):

A meeting with NASA personnel at Langley indicated a definite interest in glasses free 3D for viewing of high resolution data sets (scientific visualization). A high resolution glasses free 3D display potentially has wide application for improved pilot situation awareness aboard NASA aircraft and spacecraft, as well space based telerobotic applications such as manipulator arm operation on the International Space Station. NASA interest in cockpit displays is mainly for commercial aviation safety improvement.

Non-NASA Commercial Application(s):

NASA interest in cockpit displays is mainly for commercial aviation safety improvement. Military aircraft would also benefit. Boeing will partner with DTI in Phase II development and testing. DTI currently talking with two companies who have a definite interest in use of the technology investigated during this Phase I for a countertop point of sale application and an automotive application.

Other potential applications include scientific visualization, telerobotic operation, medical displays (especially for laparoscopic and robotic surgery), consumer game displays, and in a multiple person face tracking form, home television.

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